

Graphing Technology Lab

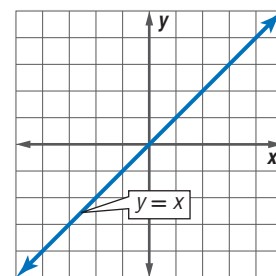
The Family of Linear Graphs

Casio FX-9750G

A family of people is related by birth, marriage, or adoption. Often people in families share characteristics. The graphs in a family share at least one characteristic. Graphs in the linear family are all lines, with the simplest graph in the family being that of the parent function $y = x$.

You can use a graphing calculator to investigate how changing the parameters m and b in $y = mx + b$ affects the graphs in the family of linear functions.

Parent Graph



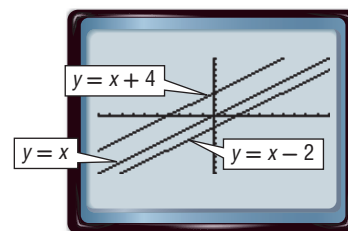
ACTIVITY 1 Changing b in $y = mx + b$

Graph $y = x$, $y = x + 4$, and $y = x - 2$ in the standard viewing window.

Enter the equations in the Y= list as Y1, Y2, and Y3. Then graph the equations.

KEYSTROKES: Review graphing in your textbook.

- How do the slopes of the graphs compare?
- Compare the graph of $y = x + 4$ and the graph of $y = x$. How would you obtain the graph of $y = x + 4$ from the graph of $y = x$?
- How would you obtain the graph of $y = x - 2$ from the graph of $y = x$?



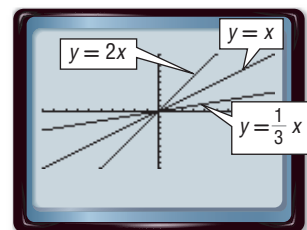
Changing m in $y = mx + b$ affects the graphs in a different way than changing b . First, investigate positive values of m .

ACTIVITY 2 Changing m in $y = mx + b$, Positive Values

Graph $y = x$, $y = 2x$, and $y = \frac{1}{3}x$ in the standard viewing window.

Enter the equations in the Y= list and graph.

- How do the y -intercepts of the graphs compare?
- Compare the graph of $y = 2x$ and the graph of $y = x$.
- Which is steeper, the graph of $y = \frac{1}{3}x$ or the graph of $y = x$?



Does changing m to a negative value affect the graph differently than changing it to a positive value?

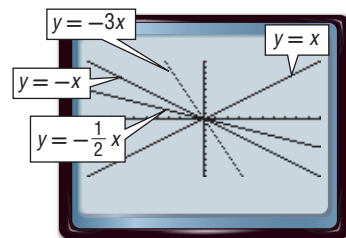
ACTIVITY 3 Changing m in $y = mx + b$, Negative Values

Graph $y = x$, $y = -x$, $y = -3x$, and $y = -\frac{1}{2}x$ in the standard viewing window.

Enter the equations in the Y= list and graph.

3A. How are the graphs with negative values of m different than graphs with a positive m ?

3B. Compare the graphs of $y = -x$, $y = -3x$, and $y = -\frac{1}{2}x$. Which is steepest?



Analyze the Results

Graph each set of equations on the same screen. Describe the similarities or differences among the graphs.

1. $y = 2x$

$y = 2x + 3$

$y = 2x - 7$

2. $y = x + 1$

$y = 2x + 1$

$y = \frac{1}{4}x + 1$

3. $y = x + 4$

$y = 2x + 4$

$y = \frac{3}{4}x + 4$

4. $y = 0.5x + 2$

$y = 0.5x - 5$

$y = 0.5x + 4$

5. $y = -2x - 2$

$y = -4.2x - 2$

$y = -\frac{1}{3}x - 2$

6. $y = 3x$

$y = 3x + 6$

$y = 3x - 7$

7. Families of graphs have common characteristics. What do the graphs of all equations of the form $y = mx + b$ have in common?

8. How does the value of b affect the graph of $y = mx + b$?

9. What is the result of changing the value of m on the graph of $y = mx + b$ if m is positive?

10. How can you determine which graph is steepest by examining the following equations?

$y = 3x$, $y = -4x - 7$, $y = \frac{1}{2}x + 4$

11. Explain how knowing about the effects of m and b can help you sketch the graph of an equation.

12. The equation $y = k$ can also be a parent graph. Graph $y = 5$, $y = 2$, and $y = -4$ on the same screen. Describe the similarities or differences among the graphs.

Extension

Nonlinear functions can also be defined in terms of a family of graphs. Graph each set of equations on the same screen. Describe the similarities or differences among the graphs.

13. $y = x^2$

$y = -3x^2$

$y = (-3x)^2$

14. $y = x^2$

$y = x^2 + 3$

$y = (x - 2)^2$

15. $y = x^2$

$y = 2x^2 + 4$

$y = (3x)^2 - 5$

16. Describe the similarities and differences in the classes of functions $f(x) = x^2 + c$ and $f(x) = (x + c)^2$, where c is any real number.